R E M A R K S

Prior to examination, entry of the present amendment is respectfully requested.

The specification and Abstract are amended to correct errors of which applicant has become aware.

It is respectfully requested that the amendments to the specification and Abstract be approved and entered.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,

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Encs.: Copy of amended pages of specification showing changes made thereto

shown in Fig. 1;

Fig. 11 is a front view illustrating an example of the main screen bonded at a junction plane perpendicular to the lenticular direction in the embodiment shown in Fig. 1;

Fig. 12 is a front view illustrating an example of the main screen bonded by cutting so as to achieve a diagonal lenticular direction in the embodiment shown in Fig. 1;

Fig. 13 is a trihedral diagram illustrating a holographic screen with degrees of diffusion different between the vertical and horizontal directions in the embodiment shown in Fig. 1;

Fig. 14 illustrates a preferred position of the junction plane in a lenticular lens sheet having black stripes in the embodiment shown in Fig. 1;

Fig. 15 is a perspective view illustrating an example of arrangement when piling two lenticular lens sheets and a transmissive diffusion screen in the embodiment shown in Fig. 1; and

Fig. 16 is a perspective view illustrating an example in which a latter-stage lenticular lens sheet simultaneously serves as a transmissive diffusion screen in the configuration shown in Fig. 15.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will now be

described with reference to the drawings.

Figs. 1 to 16 illustrate an embodiment of the invention: Fig. 1 is a plan view illustrating an observer who observes an image projected from a projector onto a screen for a rear projection type projector; Figs. 2A and 2B are perspective views illustrating the configuration of the screen for a rear projection type projector; Figs. 3A and 3B illustrate construction of a main screen by bonding two lenticular lens sheets; Fig. 4 illustrates observation of luminous fluxes passing through the junction plane of the main screen when using a rear transmissive diffusion screen as a transmissive diffusion screen; Fig. 5 illustrates observation of luminous fluxes passing through the junction plane of the main screen when using a kneaded type transmissive diffusion screen as a transmissive diffusion screen; Fig. 6 illustrates observation of luminous fluxes passing through the junction plane of the main screen when using no transmissive diffusion screen; Fig. 7 is a front view illustrating an example of the main screen bonded at the center portion; Fig. 8 illustrates the direction of the incident light entering the junction plane and the effect thereof as viewed from a side; Fig. 9 illustrates a preferred arrangement of the junction plane on the screen; Fig. 10 is a front view illustrating an example of the main screen bonded at two positions to the right and to the left

with the center portion in between; Fig. 11 is a front view illustrating an example of the main screen bonded at a junction plane perpendicular to the lenticular direction; Fig. 12 is a front view illustrating an example of the main screen bonded by cutting so as to achieve a diagonal lenticular direction; Fig. 13 is a trihedral diagram illustrating a holographic screen with degrees of diffusion different between the vertical and horizontal directions; Fig. 14 illustrates a preferred position of the junction plane in a lenticular lens sheet having black stripes; Fig. 15 is a perspective view illustrating an example of an arrangement when piling two lenticular lens sheets and a transmissive diffusion screen; and Fig. 16 is a perspective view illustrating an example in which a latter-stage lenticular lens sheet simultaneously serves as a transmissive diffusion screen in the configuration shown in Fig. 15.

This screen for a rear projection type projector comprises, as shown in Figs. 1, 2A and 2B, a main screen 5 made of lenticular lens sheets; and a transmissive diffusion screen 6 which is arranged behind the main screen 5 on the optical path of luminous fluxes as projected from a projector 2 and plays a role of diffusing luminous fluxes having passed through the main screen 5 to expand the viewing angle. The screen for a rear projection type

More specifically, the junction plane 5c is formed, as shown in Fig. 3B, by bonding an end face 5B1 corresponding to the trough 5e of the lenticular lens sheet 5B and an end face 5A1 corresponding to the trough 5e of the lenticular lens sheet 5A as shown in Fig. 3A by means of an adhesive or the like.

Operation of the aforementioned transmissive diffusion screen 6 will now be described with reference to Fig. 4.

When not using the transmissive diffusion screen 6, the focal point of the observer 3 agrees with a point near the main screen (for example, a portion represented by a reference numeral FAO) as shown in Fig. 6. Lines caused by the junction plane 5c may therefore be observed. Fig. 4 illustrates in contrast a case where the transmissive diffusion screen 6 formed as, for example, a transmissive diffusion screen for rear use is arranged. This transmissive diffusion screen is formed by coating a diffusion agent or a tinting agent (pigment) on a transparent layer 6b comprising an acrylic plate or the like, thereby forming a thin image forming layer 6a in the luminous flux passing direction. The image forming layer 6a is arranged so as to face the main screen 5.

By using such a transmissive diffusion screen 6 for rear use, luminous fluxes refracted or reflected by the junction plane 5c are diffused over a range shown by a

reference numeral FA1 in Fig. 6. Therefore, almost no line caused by the junction plane 5c is observed by the observer 3 whose eye focal point agrees with the image near the image forming layer 6a.

For example, a kneaded type transmissive diffusion screen 7 as shown in Fig. 5 may be used in place of the transmissive diffusion screen 6 shown in Fig. 4. This transmissive diffusion screen 7 is formed by kneading a diffusion agent or a tinting agent into the substrate material.

By using such a kneaded type transmissive diffusion screen 7, fluxes refracted or reflected by the junction plane 5c are diffused over a range shown by a reference numeral FA2 in Fig. 6. Therefore, almost no line caused by the junction plane 5c is observed by the observer 3 whose eye focal point agrees with the image near the transmissive diffusion screen 7.

As described above, bonding of the screen sheet members is accomplished by using, for example, an adhesive. An adhesive which has the same refractive index as that of the lenticular lens sheets is used as far as possible. However, it is still difficult to obtain completely uniform optical properties after bonding. In some cases, even an air layer may be mixed in. Such optical non-uniformity causes production of light reflection or refraction by the

distance between the main screen and the transmissive diffusion screen in the luminous flux passing direction while considering an image blur.

An example of bonding of the lenticular sheets will now be described with reference to Figs. 7 to 12.

Fig. 7 illustrates bonding of lenticular lens sheets 5f and 5g which are two screen sheet members at the center so that the right and the left form substantial symmetricity. The main screen 5 based on such bonding is suitable for projection of a usual single image from the projector 2, and in addition, suitable for a case, for example, where a so-called multi-screen is often projected.

A preferred example of arrangement of the junction plane 5c in the screen will be described with reference to Figs. 8 and 9.

In a system using a single projector 2, in general, light enters substantially vertically to the screen for a rear projection type projector 1 near the center of the screen, and diagonally at an angle in portions other than the center portion.

The junction plane 5c is formed as a bonding layer 5f as shown in Fig. 8 by using an adhesive as described above. When light comes in vertically (arrow A direction) the bonding layer 5f, the light passes only through the bonding layer 5f and is emitted. As a result, the degree of

diffusion of the light by the junction plane 5c is relatively low.

The light entering diagonally at an angle larger than a certain value to the junction plane 5c passes first through first the lenticular layer of the lenticular lens sheet 5G, then the bonding layer 5f, and finally the lenticular layer of the lenticular lens sheet 5F in this sequence (see the arrow B). The degree of diffusion of the light by the junction plane 5c is therefore higher than in the vertical incidence represented by the arrow A. When the light enters diagonally to the junction plane 5c, therefore, seams between the lenticular lens sheets become more distinct for the observer.

In the example shown in Fig. 9, contrivances are made in the arrangement, paying attention to the fact that vertical incidence of light to the bonding layer 5f leads to a slighter effect of the junction plane on the image than the diagonal incidence.

As shown in Fig. 9, the screen 1 for a rear projection type projector is arranged vertically to the optical axis 0 of the luminous flux projected from the projector 2, and the junction plane 5c is arranged at a position where the junction plane 5c substantially crosses the optical axis 0.

In the example shown in Fig. 9, in which projection is conducted from a single projector 2, the configuration is

lens sheet itself has a function of diffusing the light. Even in this configuration, therefore, it is possible to reduce the optical effect of the junction plane 5c and thus to form a screen in which streaks are hard to be found.

The lenticular lens screen and the holographic screen have been presented above as examples of the main screen formed by bonding a plurality of screen sheet members. The bonded main screen in the invention is not limited to the above, but a Fresnel screen or a bead screen may be used.

According to the embodiment of the invention, which provides a large-area main screen formed by bonding a plurality of screen sheet members, the necessity is eliminated to use a new manufacturing line for integrally forming large-area screen sheet members, and it is possible to manufacture a screen for a rear projection type projector of a desired size while reducing the cost.

Furthermore, because a transmissive diffusion screen is arranged on the observer side of the main screen comprising a plurality of bonded screen sheet members, the junction plane exerts almost no effect on the observed image, thus enabling to enjoy a high-definition large screen.

Since the junction plane is arranged at a position where it substantially crosses the optical axis at the center of the main surface of the main screen, it is possible to inhibit scattering of light caused by the